REMARKS

Claims 9-11 and 16-19, all the claims pending in the application, stand rejected. Applicant has amended claims 9 and 16 in order to clarify the language that defines the structure of the photonic crystal. New claims 29-32 have been added. As to the new claims, additional limitations have been added with respect to a shape of the second end face or the second boundary face. This clearly is different from the structure of the prior art.

Claim Rejections – 35 USC 102

Claims 9-11 and 16-18 are rejected under 35 USC 102(e) as being anticipated by Koide (6,448,997). This rejection is traversed for at least the following reasons.

Independent claim 9 is directed to an optical deflection element comprising a photonic crystal having a refractive index that changes periodically *depending on a location* of the photonic crystal. The invention is featured by the optical deflecting element having a first end face and a second end face, and wherein a shape of the second end face of the optical deflection element is determined in such a manner that a plurality of light beams incident upon the first end face at the same incidence angle and *having different wavelengths* are emitted from the second end face in different directions corresponding to the wavelengths.

As a preliminary matter, the Examiner appears to have misinterpreted the intended meaning of the phrase "refractive index which changes periodically *depending on a location of* said photonic crystal." From the illustrations in Figs. 2-6, it is apparent that the phrase means that the refractive index changes depending on a location within the photonic crystal. The presence of the large circular holes 20 in a periodic distribution within the silicon medium 21 causes the refraction of light to change within the photonic crystal. As taught at page 10, the periodic distribution of holes (filled with air or other material) in a two-dimensional triangular lattice arrangement causes the refractive index of the optical element 10 to be changed periodically (cyclically or alternately). Applicant has clarified this language, but this change is not intended to be a basis for distinguishing over Koide (e.g., Fig. 3 of the reference). The claimed invention is distinguishable as previously presented.

In defining the invention, claim 9 clearly states that a shape of the second end face of the optical deflection element is determined in such a manner that a plurality of light beams incident upon the first end face at the same incidence angle and having different wavelengths are emitted from the second end face in different directions corresponding to the wavelengths. Beginning at page 21, with reference to Figs. 10 and 11 for the second exemplary embodiment of the invention, the specification describes the manner in which the second surface is shaped. Notably, in the description of the design, the ability of the photonic element to change the direction of light in response to changes of wavelength is assumed to be known. The main focus of the invention is on shaping the second surface, as explained at page 22 as follows:

> [A]n angle defined between the tangential direction on the first end face 41 and a tangential direction on the second end face 42 at an arrival point of each of the propagation light beams is determined in such a manner that the respective propagation light beams propagated through the optical deflection element 40 are emitted from the second end face 42 in the different directions from each other. Concretely speaking, an angle ϕ_O is set to a maximum value of 53 degrees where the angle ϕ_O is defined between the tangential direction on the first end face 41 and a tangential direction on the second end face 42 at an arrival point of such a propagation light beam having a refractive angle θ_P = 69 degrees. Also, an angle ϕ_O is set to a minimum value of -69 degrees where the angle ϕ_O is defined between the tangential direction on the first end face 41 and a tangential direction on the second end face 42 at an arrival point of such a propagation light beam having a refractive angle θ_P = -50 degrees. By determining the shape of the second end face 42 in such a manner, a light beam, which is incident upon the first end face 41 at the normalized frequency Ω of a range from 0.657 to 0.669, is deflected from the second end face 42 in different directions at an emergence angle in such a wide range from +59.3 degrees to -89.4 degrees. As a result, according to the second embodiment, the incident light beams having different wavelengths can be deflected in different directions in the wide range, while the

optical deflection element is not made large, but also the manufacturing cost thereof is not increased.

Thus, the present invention concerns an improvement over the conventional photonic device that changes direction of a light beam in response to changes in frequency. The present invention permits an even greater capability to scan a light beam in a wider range of angles. This feature is set forth in claim 9 by the recitation that the second surface is "*determined in such a manner that a plurality of light beams incident upon the first end face at the same incidence angle and having different wavelengths are emitted from the second end face in different directions corresponding to the wavelengths.*"

Koide

Koide discloses a laser beam scanning system as illustrated in Fig. 2 where a laser light source 4 selectively generates a beam with a variable wavelength in response to a control circuit 15. The variable wavelength beam is incident onto a modulator 2, which adds information to the beam, and the modulated beam is presented to a collimator lens 3 and then a photonic crystal 1 to provide scanning, in accordance with the teachings at col. 3, lines 7-46. An illustration of the photonic device 1, including its periodic structure and the variable angle of deflection based on wavelength, is provided in Fig. 3. Notably, both the incident surface and the emission surface are planar. Applicants respectfully submit that light incident onto a first surface is deflected and emitted from the second surface, but that there is no teaching of *a plurality of light beams incident upon the first end face at the same incidence angle and having different wavelengths are emitted from the second end face in different directions corresponding to the wavelengths.*

Independent Claim 16 concerns an optical deflection element comprising a first normal optical medium, a second normal optical medium and a photonic crystal provided between the first and second normal optical media and having a refractive index which changes depending on a location of the photonic crystal. The exemplary but non-limiting embodiment of Fig. 14 illustrates an element 60 where a first normal optical medium 61, and second normal optical medium 62 have a photonic crystal 63 there between. The illustrated structure is clearly in a sandwiched form and is described at page 25 as having a first boundary surface 64 between the

first normal optical medium and the photonic crystal and a second boundary surface 65 between the second normal optical medium and the photonic crystal. The shape of the second boundary surface of the optical deflecting element is determined in such a manner that a plurality of light beams incident upon the first boundary surface at the same incidence angle and *having different wavelengths* are emitted from the second boundary surface in different directions corresponding to the wavelengths.

Koide does not have such sandwiched structure where there are boundary surfaces between adjacent elements, and thus, cannot anticipate the claimed invention. The Examiner's comment at page 3 refers to the structures in Figs. 2 and 3 of Koide, and in particular, points to collimator lens 3 as the "first normal optical medium" and to diffractive grating 5 as the "second normal optical medium. However, as is clear from the illustration in Fig. 2, these three structures are separated from each other. Moreover, there is no teaching or suggestion in the disclosure of Koide that these elements may be integrated into a common structure having a "boundary surface" on opposite sides of the photonic element.

Should the Examiner persist in his rejection, Applicant respectfully requests that the Examiner provide a supporting teaching that a lens, photonic element and grating of the type illustrated in Koide can be integrated with common boundaries. Applicant respectfully submits that the Examiner cannot find such teaching. Thus, the rejection should be withdrawn and independent claim 16 and the claims that depend there from should be found patentable.

Claim Rejections – 35 USC 103

Claim 19 is rejected under 35 USC 103(a) as being unpatentable over Koide (6,448,997). This rejection is traversed for at least the following reasons.

First, this claim is dependent on claim 16 and would be patentable for the reasons already given.

Second, the Examiner again relies on the lens 3 and grating 5 to be the normal optical media and asserts that the claimed structure is found in Koide. The Examiner admits that Koide does not disclose that the material of the lens 3 and grating 5 is not the same as materials that

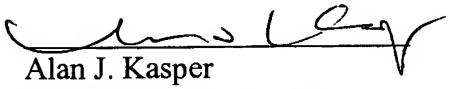
constitute the photonic crystal. The Examiner asserts, without any support, that the material of the lens and grating can be the same as that of the photonic crystal material.

Applicant would submit that there is no teaching or suggestion that these elements may be integrated into a common structure having a "boundary surface" on opposite sides of the photonic element and having a common material for the lens, grating and photonic element. Again, should the Examiner persist in his rejection, Applicant respectfully requests that the Examiner provide a supporting teaching that a lens, photonic element and grating of the type illustrated in Koide can be integrated with common boundaries and made of a common material. Applicant would submit that the Examiner cannot find such teaching. Thus, the rejection should be withdrawn and claim 19 should be found patentable.

In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

Respectfully submitted,



Alan J. Kasper
Registration No. 25,426

SUGHRUE MION, PLLC
Telephone: (202) 293-7060
Facsimile: (202) 293-7860

WASHINGTON OFFICE
23373
CUSTOMER NUMBER

Date: June 20, 2005